Characterization Package Supplement for Sampling and Analysis of Roofing Material from Groups B & C for Isotopic Analysis

(addition to Appendix 8 of SWP-RFCSS-0002-00)

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Outline

ACRONYM LIST

ADM	Administrative Procedures Manual
AP2	Alpha Spectroscopy
ASD	Analytical Services Division
CAS	Commodore Advanced Sciences
CCR	Colorado Code of Regulations
CDPHE	Colorado Department of Public Health and Environment
COC	Chain of Custody
CPM	Counts Per Minute
DOT	Department of Transportation
DQO(s)	Data Quality Objectives
EPA	Environmental Protection Agency
FIDLER	Field Instrument for the Detection of Low Energy Radiation
KH	Kaiser Hill, L.L.C
MARSSIM	Multi Agency Radiation Survey and Site Investigation Manual
MDA	Minimum Detectable Activity
NORM	Naturally Occurring Radioactive Materials
PA	Protected Area
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
ppm	Parts Per Million
QA	Quality Assurance
QC	Quality Control
QE	Quality Engineer
RCRA	Resource Conservation and Recovery Act
REP	Radiological Engineering Procedure
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RIN	Report Identification Number
RMRS	Rocky Mountain Remediation Service, L.L.C
ROI	Radiological Operating Instructions
RSP	Radiological Safety Practices
SAP	Sampling and Analysis Plan
SOPs	Standard Operating Procedures
TSA	Total Surface Activity

1.0 INTRODUCTION

Due to past RFETS experience with similar structures and materials, (i.e. trailer roofs such as from the T690 trailer complex and T112B), analytical samples of metal roofing material are required to determine if elevated fixed alpha contamination measurements observed during field surveys are due to DOE-added radionuclides.

2.0 DATA QUALITY OBJECTIVES (DQOs)

Decisions must be made as to whether trailer roofs are radiologically contaminated or eligible for free-release from the site. These decisions are based on both radiological surveys and radiochemistry samples. DQOs herein address only the radiochemical characterization needs of the project, which is to determine the nature of the radioactive material causing elevated TSA (fixed) as measured by field instrumentation (NE Electra instrument) within the MARSSIM framework. MARSSIM survey requirements have already been completed. Based on visual inspections and historical use of the trailer for administrative purposes only, potential for chemical hazards within or on the trailers has been ruled-out (with the exception of non-friable asbestos, which does not impact this characterization package). Radiological pre- and post-sampling surveys will be performed as a matter of course to ensure compliance with conduct of radiological operations (RSP–16.03).

2.1 The Problem

The quantity and types of radioactive contamination present on the trailer roofs are not known with adequate confidence to ensure compliance with free-release criteria; therefore, additional measurements must be taken to properly characterize the trailer as contaminated or not contaminated. All areas of the trailers were characterized through previous radiological surveys; however, the identity of radionuclides of interest within bulk material on trailer rooftops must be established through radiochemical analysis because initial alpha TSA readings (fixed) were elevated and did not decay to levels below free release, which indicates contamination. However, based on site history and process knowledge, naturally occurring radioactive materials (NORM) are suspected as the source of elevated alpha readings, particularly Po-210. These DQOs will determine whether the trailer roof has elevated TSA (above free-release levels) due to DOE-added radionuclides.

2.2 Identification of Decisions

1) Are elevated survey (TSA) measurements due to DOE-added radionuclides?

2.3 Inputs to the Decisions

Inputs to the decisions include:

- Radiochemistry quantitative results (U-233/234, U-235, U-238, Am-241 and Pu-239/240) from 26 samples (12 trailers x 2 roof samples/trailer, plus 2 samples from the metal sides of T903A) of interest on various trailers listed in §3.0 . Results shall be reported in dpm/sample or pCi/g/sample (ultimately to be converted to dpm/100 cm^2).

- Radiochemistry qualitative results from the above samples, such as identification of peaks by alpha spectroscopy to identify other potential sources of elevated alpha measurements associated with these samples, including Po-210.
- Duplicate samples, 1 per trailer roof. Duplicate sample results will be compared with each associated real sample. If both results are below free-release limits, repeatability of samples is considered acceptable; otherwise, contamination or excessive variability is indicated and decontamination and/or low-level wasting will result due to exceedance of free-release levels.
- Radon progeny or other potential isotopes contributing to the elevated alpha readings recorded during previous radiological field surveys measured by both laboratory radiochemical (Po-210) and field AP-2 (Po-218 and Po-214) methods.
- Quality assurance aspects of the data, including precision, accuracy, representativeness, completeness, comparability, and sensitivity (i.e., the PARCC parameters),
- Unrestricted release criteria – DOE Order 5400.5.

2.4 Definition of the Boundaries
Three-dimensional boundaries are restricted to the trailer rooftop exteriors.

2.5 Decision Rules
Comparison of field results with action levels will be performed by adding all Uranium (U) isotope results and comparing the total with U action levels, (i.e. 5000 dpm/100 cm^2). Likewise with the transuranic radionuclides, the sum of all isotopic results for transuranic radionuclides (i.e. Pu-239/240, Am-241,) will be compared to the transuranic action levels (e.g. 100 dpm/100 cm^2).

1) If all total surface contamination results, as measured through media samples, are below the (total, or fixed) surface contamination thresholds as defined in DOE Order 5400.5, the survey unit may be free-released. Otherwise, the survey unit is considered radiologically contaminated and the unit must be reclassified.

2.6 Limits on Decision Errors
Decision errors shall be less than 10% for alpha and beta (error types), respectively, for each roof, relative to the activities of DOE-added radionuclides. Statistical confidence will not be assigned to measurements regarding radon progeny or other NORM, as these will be considered qualitative only.

2.7 Optimization of the Sampling Design
Confidence in the number of samples will be evaluated through use of the EPA G-4 model, i.e., to ensure that enough samples were acquired to provide at least 90% confidence in the decision as to whether DOE-added radionuclides are present above (or below) free-release levels. If results indicate contamination levels greater than free-release levels, materials within the survey unit will be considered low-level waste.

3.0 SAMPLING AND ANALYSIS

3.1 Radiological Sampling

Samples will be collected per the requirements in PRO-477-RSP-16.03, *Radiological Samples of Building Media* for roof samples. Specifically, Sections 7.1.1, 7.1.3, 7.2 and 7.4.3 of RSP-16.03 apply. A Radiation Work Permit (RWP) is required for all sampling events. At each location, two adjacent samples will be collected, and placed into two separate bottles (i.e., same event, different bottle number). Each sample will be cut into a round, token shape through use of a hand-held drill and coring bit and/or tin snips. The optimal diameter of the token-shaped sample will be 1 inch. Quality control samples consist of one field duplicate per rooftop, collected in the same way as above (i.e., two adjacent samples) and co-located adjacent to 1 of the 2 real locations, and will be submitted "blind" to the lab.

Sampling locations will be defined as the two locations per roof or per wall that have the most elevated TSA measurement AND are also accessible by ladder (i.e., the sampler will acquire the sample from the ladder without standing on the roof, due to H&S restrictions/fall hazards). Sample locations will be labelled to allow traceability of sample location to the physical sample. The "bottom" of the token will be marked with indelible ink to ensure that the exposed side of the roof is the side measured via alpha spec.

The following trailers exterior roof tops (and/or exterior walls) will have two adjacent samples taken at each of two sampling locations (plus a QA duplicate location):

GROUP B	GROUP C
T881A	T771D
T881B	T331
T883A	T750E
T883B	T903A*
T883C	T331A
T439D	~~B595~~** B575

*Two samples from the north exterior wall of T903A will also be taken.
** B595 will be sampled only if elevated alpha TSA readings are observed.

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Table 1 Summary of Total Number of Samples for Group B & C Trailer Roofs

Sample Type/Purpose	# of Samples	Sampling Location
Real samples (radionuclides – RFETS suite)	2 per Roof	2 greatest elevated readings within reach from a ladder
Real samples (radionuclides – RFETS suite)	2 on N ext. wall, T903A	2 greatest elevated readings within reach from a ladder
QC duplicate sample	1 per surface	adjacent to 1 of the 2 real samples defined above
Total Number of Samples	**39**	[# of surfaces] x [(# of real + # of QC samples)]

One complete set of samples (i.e., bottle 001 from every event) will be sent to the B559 on-site laboratory and analyzed for the five radionuclides of concern (Pu-239/40, Am-241, U-233/234, U-235, and U-238). If quality requirements are not met onsite, the second complete sample set (i.e., bottle 002 from every event) will be sent to an ASD-approved offsite lab for analysis.

Sample custody will be maintained and documented using RFETS chain of custody forms. Wide mouth glass sample jars will be used to collect samples, and signed custody seals will be applied after sample collection. Each sample will be assigned a unique number in accordance with the RFETS Analytical Services Division (ASD) requirements.

The unique sample number will be broken down into the following three parts:

- Report Identification Number (RIN)
- Event Number
- Bottle Number

The first part of the number will be the RIN, which is assigned by the ASD. The RIN is used by the ASD to track and file analytical data. It is expected that one RIN will be assigned, however, if the project is not completed quickly, ASD may assign additional RINs. The RIN will be a seven digit alphanumeric code starting with "00" for 2000. The RIN will be followed by a dash "-" and then the event number. The event number is a three digit code, starting with "001" under the RIN, and will be sequential. Each typical sample location will have a unique event number under the RIN. The event number will be followed by a period "." and then the sequential bottle number. The bottle number will be used to identify individual sample containers collected at the same location and same event number.

In addition to the sample numbering scheme above, documented information will include:

- Sample type, and
- Location code

Sampling equipment (e.g., cordless drill with coring drill bit, utility knife, tin snips) will be decontaminated between sampling locations. Decontamination will be performed using triple wash and rinse process in conjunction with Alconox or Liquinox detergent and distilled or de-ionized water followed by wiping with a Kim-wipe™. Sampling information shall be documented on field logbooks as per procedure 2-S47-ER-ADM-05.14. The originator shall authenticate (legibly sign and date) each completed hardcopy of the data. A peer reviewer, someone other than the originator, shall perform a review of the logsheet/notebook. The peer reviewer shall authenticate each hardcopy completed by the originator. Any modifications shall be lined-through, initialed, and dated by the reviewer (in ink). The QA Records for the project include the logbook and chain-of-custody forms.

3.2 Radiochemical Analysis

The individual weight of each samples will be determined using a calibrated scale and recorded. Additionally, the area of each circular sample will be measured with a caliper (0.1" resolution) and recorded in square inches and square centimeters. Samples must be flat and as close as possible to a 1" diameter for optimal placement in the alpha spectrometry counting chamber.

The information listed below is required to corroborate that quality requirements (consistent w/ MARSSIM and DOE O414.1) are achieved. These requirements are generally consistent with those contractually required by K-H ASD for offsite lab services. The deliverable (data package), from the lab to the project, must include quality records (hardcopy and/or digital) that communicate the following elements, listed under each of the data quality categories.

ACCURACY

- annual or semi-annual multi-point calibration results (relative to activity or efficiency), including pass/fail criteria
- background, if used in calculation of sample activity (or concentration)
- periodic check results (energy and activity [or efficiency]) and pass/fail criteria; LCS value should be between 5 x and 30x MDA for the sample
- certificates of standards used in calibrations and performance checks
- blank results
- total propagated uncertainty: (counting error) + (systematic error)

SENSITIVITY

- minimum detectable activity in dpm (MDA) or pCi/g. In order to account for potential alpha attenuation due to the fact that the sample is not prepared by chemical separation or extraction methods, MDA must be $\leq$ **50 dpm/100cm^2** for Am-241, and the same for Pu-239/240. **It is important to note that for a 1 inch diameter circle, this is 2.5 dpm / sample.**)

PRECISION

- lab duplicate (or replicate) results and pass/fail criteria

REPRESENTATIVENESS

- references of any and all Standard Operating Procedures used for sample preparation and analysis
- completed Chain-of-Custody (COC) forms (originally submitted from the field to the lab)

MISCELLANEOUS TECHNICAL SPECIFICATIONS

- surface area of specimen face that was counted
- mass of gross sample submitted to the lab
- mass estimate of dissolved sample if wet chemistry sample prep is required
- count time (sample count time must be greater than or equal to background count time)
- sample results in dpm (pCi/g if wet chemistry sample preparation is required)

- any QA qualifications associated with the results
- **MDA for each individual sample must be explicitly reported with all sample data**

4.0 QUALITY ASSURANCE

All quality-affecting components and processes within this project will comply with the K-H Team QA Program and MARSSIM guidelines. All results will be evaluated through a data quality assessment using EPA, MARSSIM guidance, and RSP 16.04 as applicable. PARCC parameters are generally described as follows:

- **Precision** – A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision.

- **Accuracy** – A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement.

- **Representativeness** – A qualitative characteristic of data quality defined by the degree to which that data absolutely and exactly represents the characteristics of a population. Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. Samples will be collected in accordance with the following procedures:

    - PRO-477-RSP-16.03 Section 7.4.3, *Radiological Samples of Building Media*

    - MARSSIM, NUREG 1575, Dec. 1997

- **Completeness** – A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO goals.

- **Comparability** – A qualitative measure defined by the confidence with which one data set can be compared to another. MARSSIM methodology sets these parameters by comparing the sum of field data results with Action Levels.

- **Sensitivity** – The lowest level of resolution that an instrument or measurement system can consistently measure with a stated level of confidence.

5.0 REFERENCES

PRO-477-RSP-16.03	Radiological Sampling of Building Media
PRO-478-RSP-16.04	Radiological Survey/Sample Data Analysis
3-PRO-141-RSP-09.01	Unrestricted Release of Property, Material, Equipment and Waste
5-210000-OPS-FO.11	Field Communications
2-S47-ER-ADM-05.14	Use of Field Logbooks and Forms

USEPA, 1994 EPA QA/G-4, *Guidance for the Data Quality Objective Process*

MARSSIM, NUREG 1575, Dec. 1997